Supergravity
in Phenomenology and Cosmology

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CMSSM - supergravity inspired
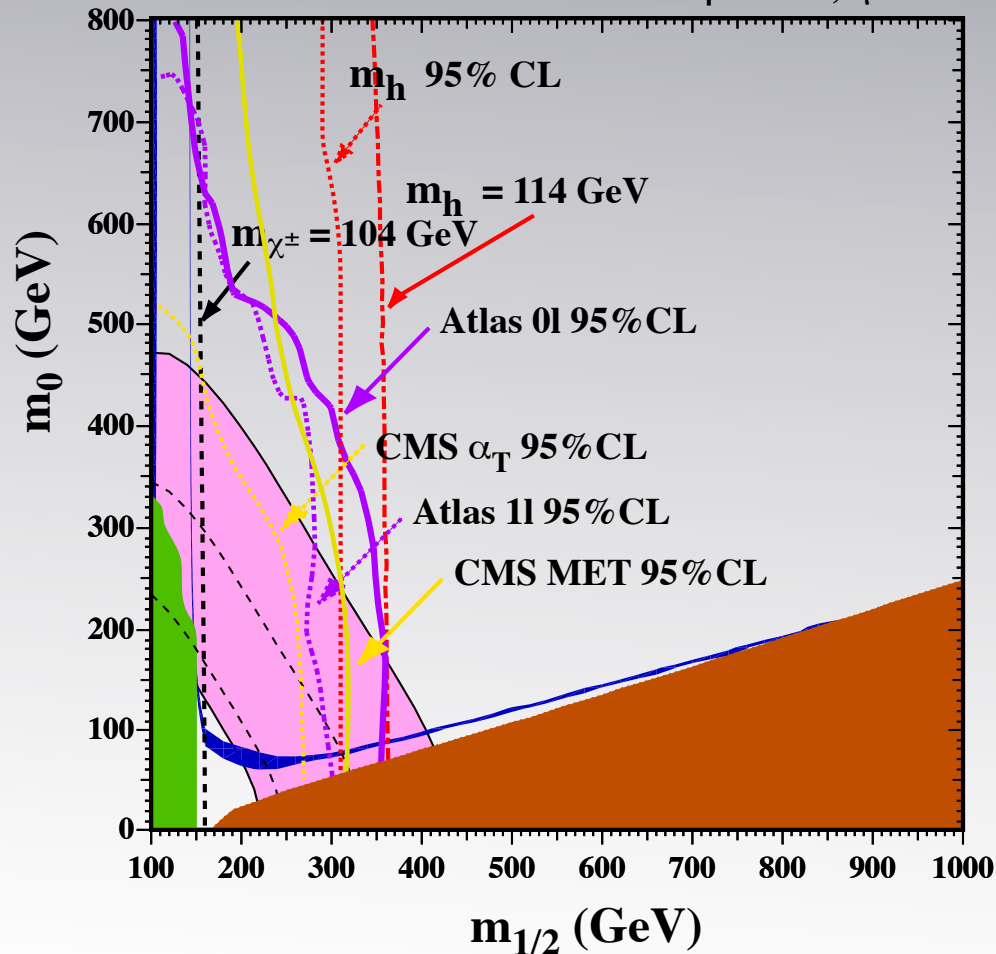m_0, $m_{1/2}$, A_0, $\tan \beta$

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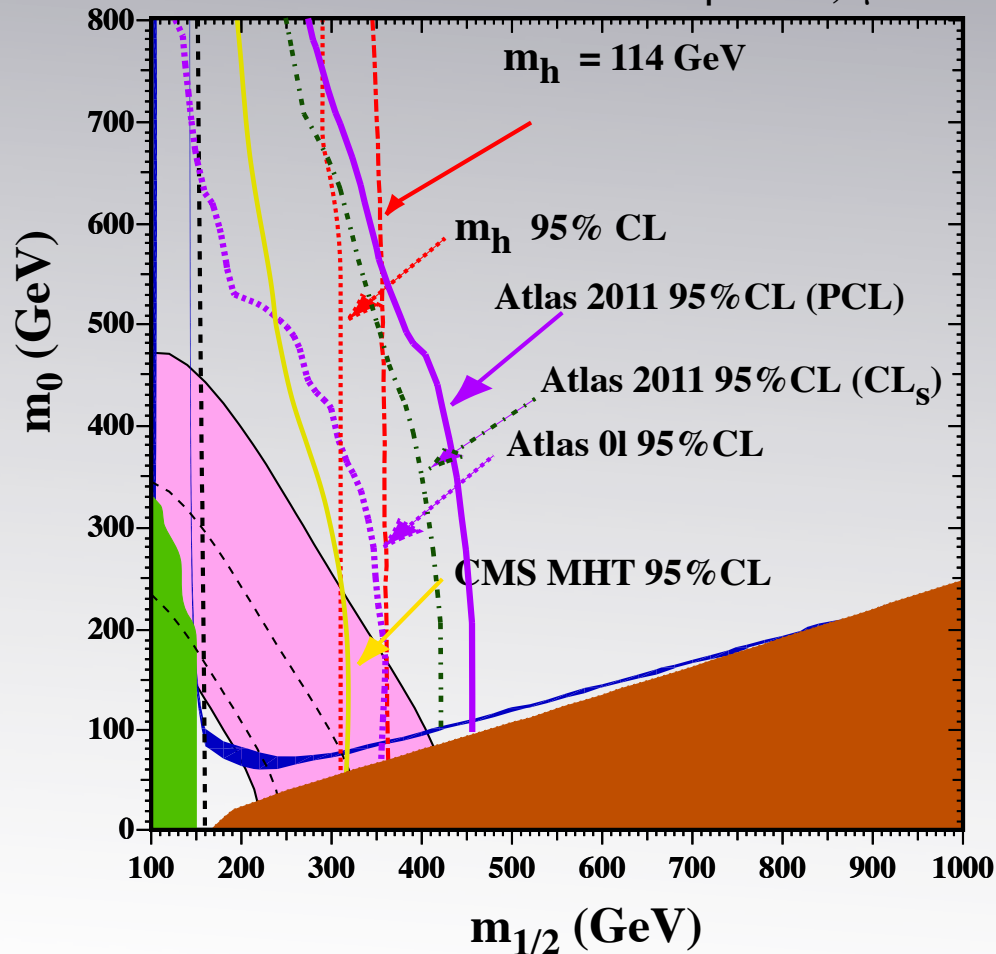m_0, $m_{1/2}$, A_0, $\tan \beta$

$\tan \beta = 10$, $\mu > 0$

$m_h = 114$ GeV

m_h 95% CL

Atlas 2011 95% CL (PCL)

Atlas 2011 95% CL (CL$_s$)

Atlas 0l 95% CL

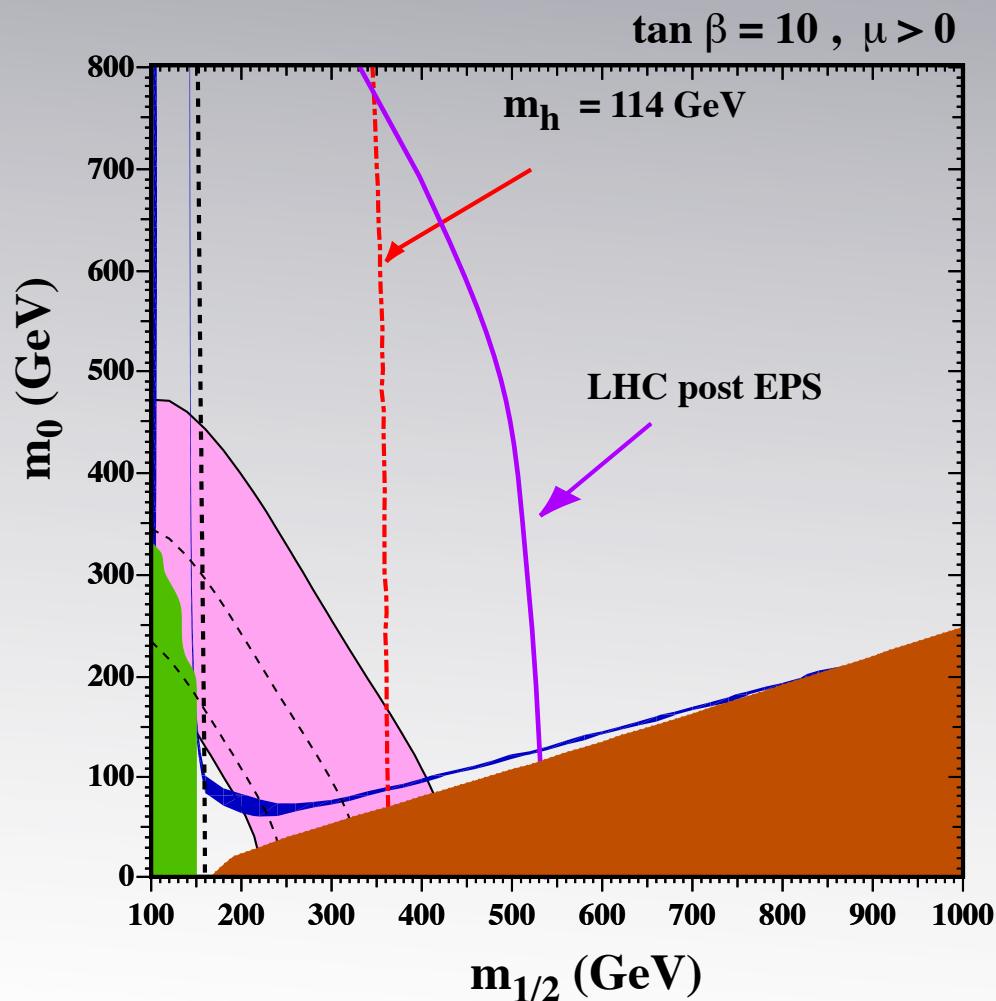CMS MHT 95% CL

m_0 (GeV)

$m_{1/2}$ (GeV)

Ellis, Olive, Santoso, Spanos

Supergravity
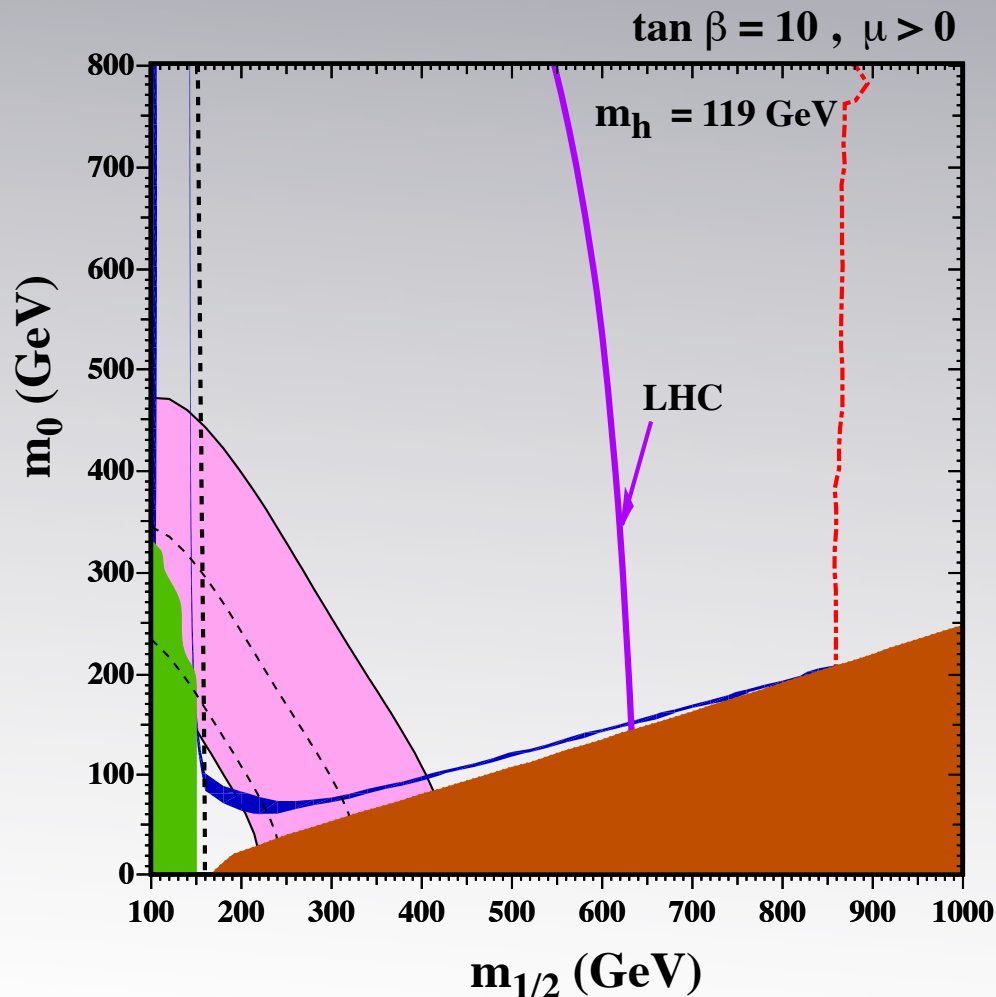# in Phenomenology and Cosmology

CMSSM - supergravity inspired
m_0, $m_{1/2}$, A_0, $\tan \beta$

Supergravity
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CMSSM - supergravity inspired
m_0, $m_{1/2}$, A_0, $\tan \beta$

$\tan \beta = 10$, $\mu > 0$

$m_h = 119$ GeV

LHC

m_0 (GeV)

$m_{1/2}$ (GeV)

Ellis, Olive, Santoso, Spanos
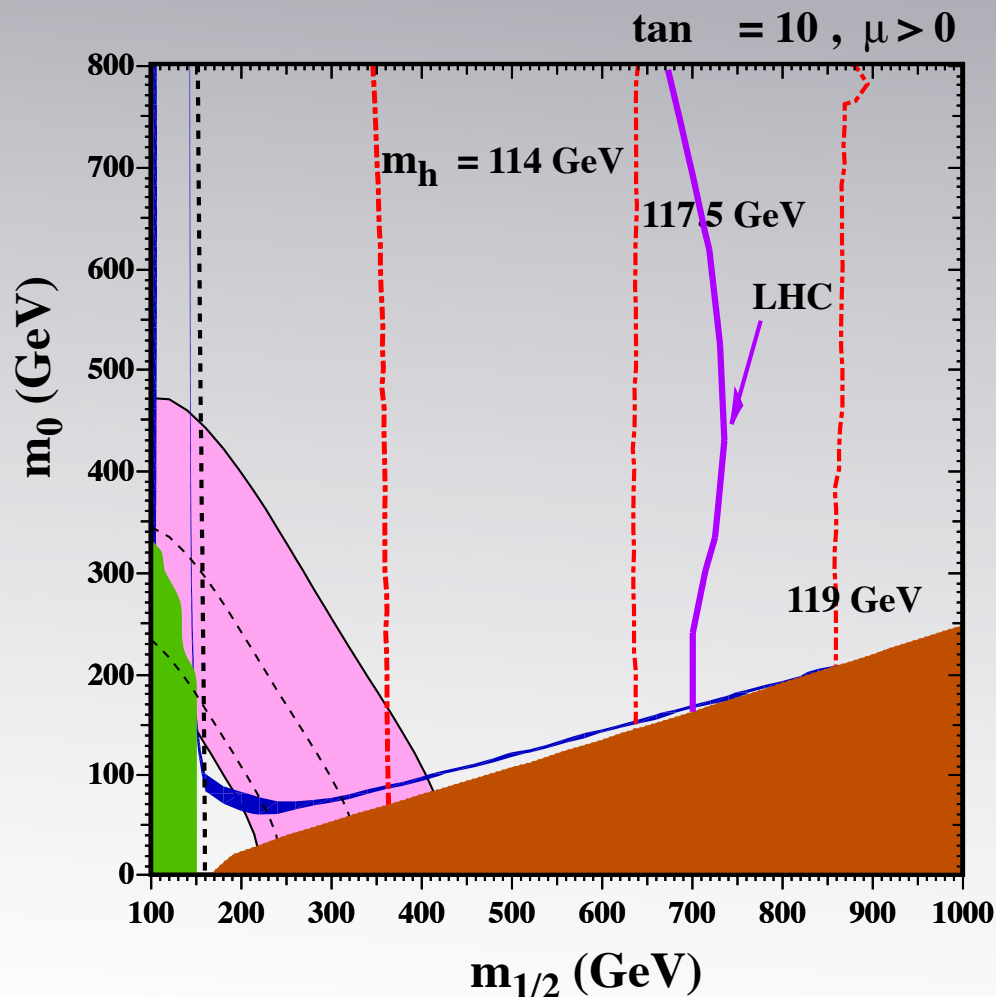
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Supergravity
in Phenomenology and Cosmology

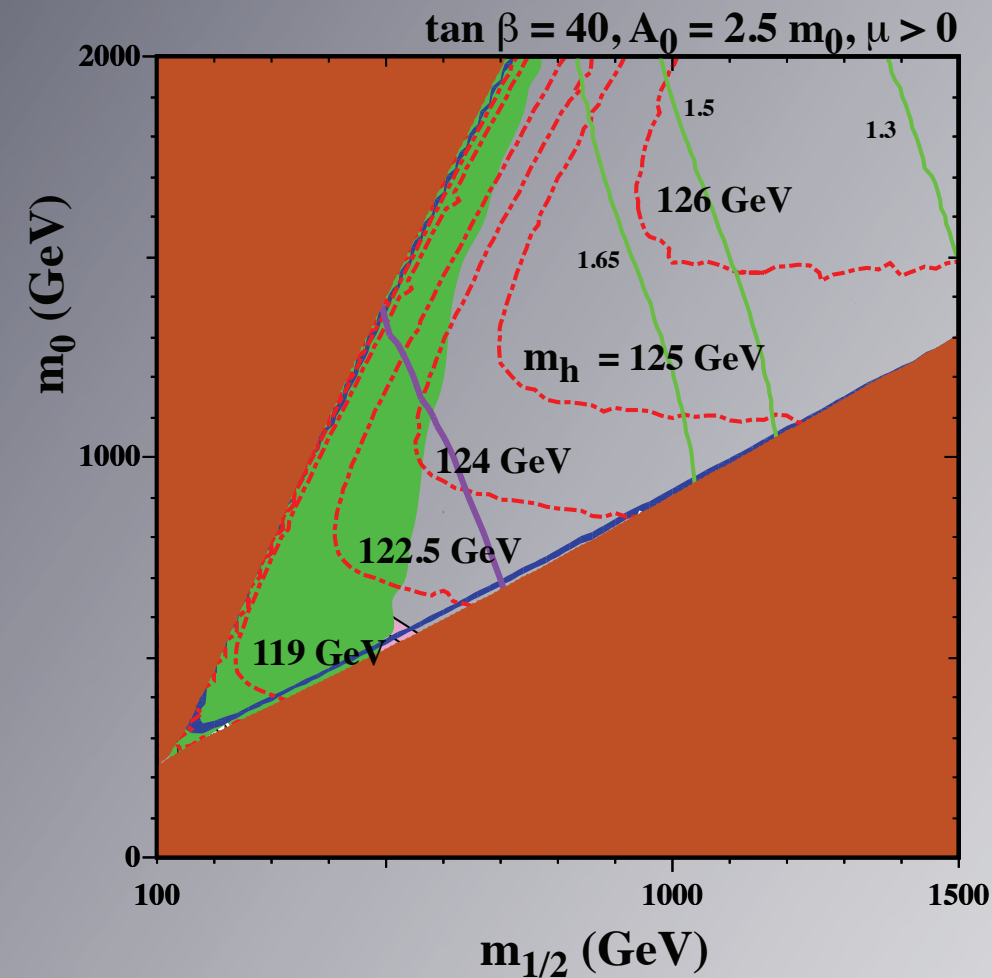CMSSM - supergravity inspired
m_0, $m_{1/2}$, A_0, tan β

Mastercode - Buchmuller et al.

CMSSM with large A_0 to get $m_h \sim 125$ GeV

B→µ⁺µ⁻ becomes an important constraint

3 parameter mSUGRA
model: $m_{3/2}$, $m_{1/2}$, A_0
$\left(\tan \beta \text{ - fixed by } B_0 = A_0 - m_0\right)$

+

SubGUT universality: M_{in}

$A_0/m_0 = 3 - \sqrt{3}$, $\mu > 0$, $M_{in} = 10^{10}$ GeV

$m_h = 125$ GeV

$\tan \beta = 35$

124 GeV

$\tan \beta = 30$

122.5 GeV

119 GeV

$\tan \beta = 25$

1.5

$\tan \beta = 55$

1.65

m_0 (GeV)

$m_{1/2}$ (GeV)
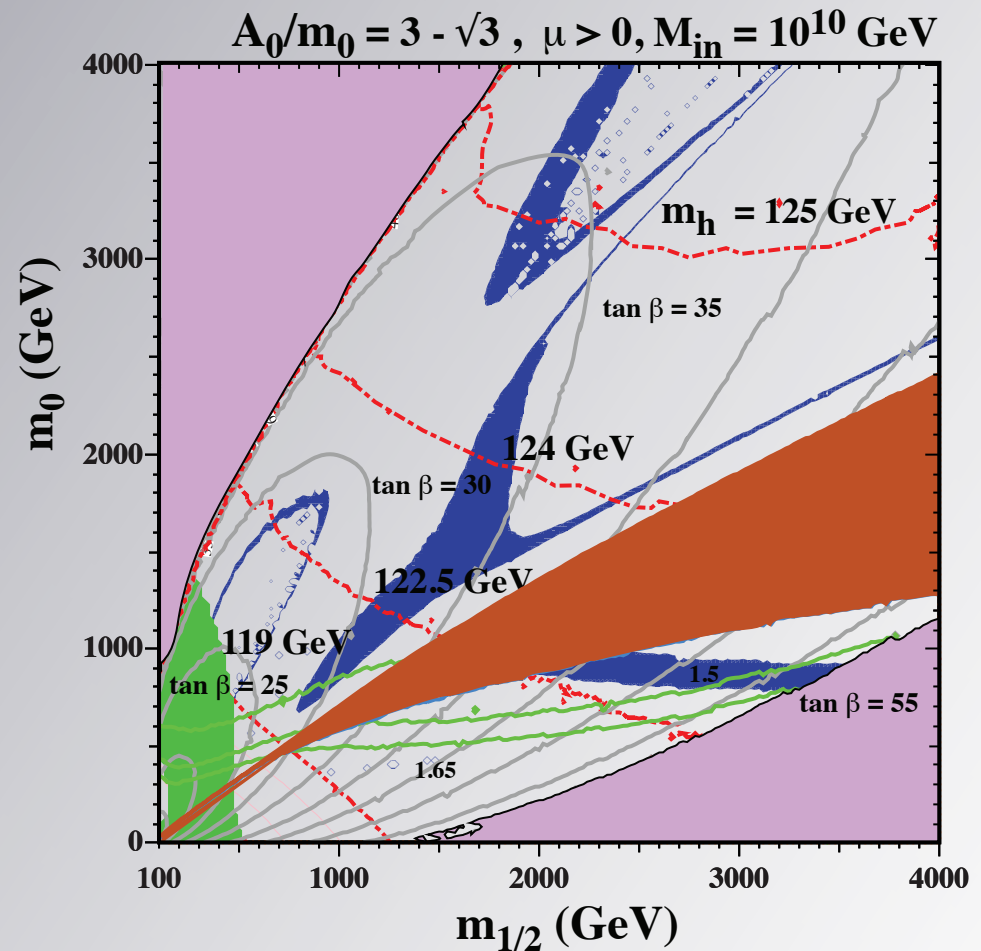
Strong Moduli Stabilization/Pure Gravity Mediation

## Heavy volume modulus ($m_T \sim M_P$) with heavy Polonyi-like field ($m_Z \gg m_{3/2}$)

Dudas, Linde, Mambrini, Mustafayev, Olive

- The sfermion, higgsinos, heavy Higgses and gravitino have masses O(100) TeV.

- The gaugino masses are in the range of hundreds to thousands of GeV.

- The LSP is the neutral wino which is nearly degenerate with the charged wino.

- The lightest Higgs boson mass is consistent with the observed Higgs-like boson, i.e. $m_h \sim 125 - 126$ GeV.

Strong Moduli Stabilization/Pure Gravity Mediation

Two parameter model!

- $m_0 = m_{3/2}$; $\tan \beta$

- gaugino masses (and A-terms) generated through loops

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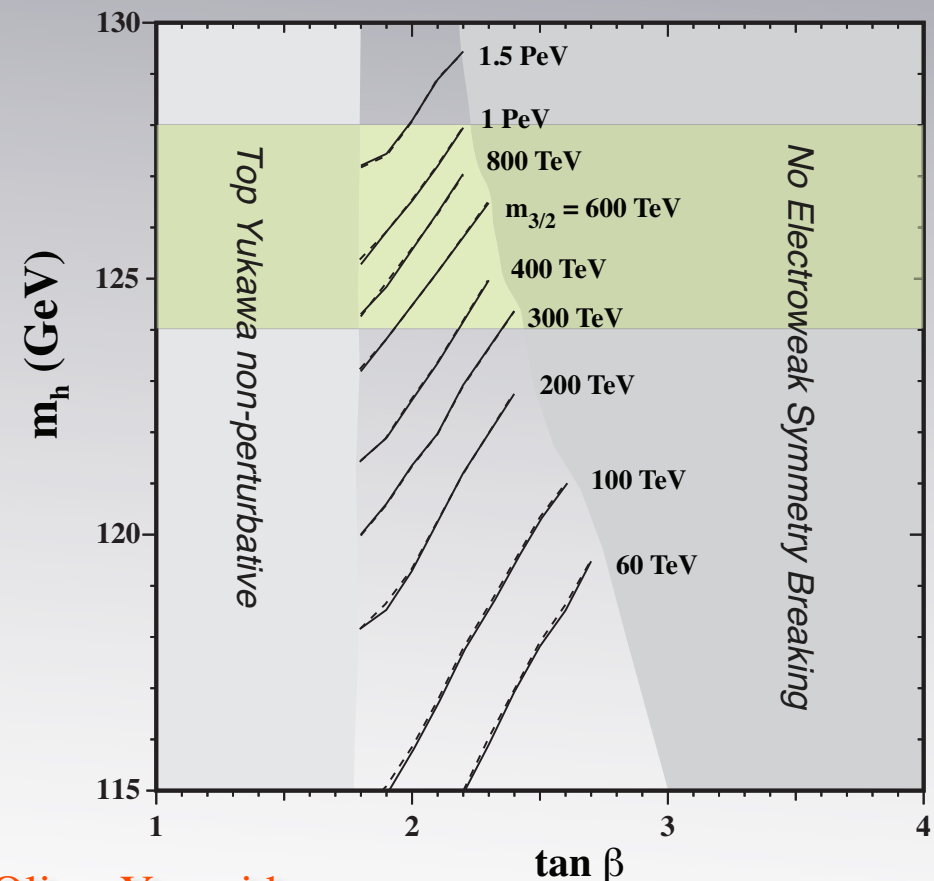
Evans, Ibe, Olive, Yanagida

Inflation

$$K = -3\ln\left(T + T^* - \frac{\phi\phi^*}{3}\right)$$

- as the inflaton

$$W = M\left[\frac{\phi^2}{2} - \frac{\phi^3}{3\sqrt{3}}\right]$$ Ellis, Nanopoulos, Olive

T - as the inflaton

$$W = \sqrt{3}M\phi(T - 1/2)$$ Cecotti; Kallosh, Linde

Equivalent to R + R^2 (Starobinsky) model of gravity